GEISINGER GRAY'S WOODS AMBULATORY CARE CAMPUS PHASE 1

PATTON TOWNSHIP, CENTRE COUNTY, PENNSYLVANIA

TECHNICAL REPORT 3
SENIOR THESIS
December 3nd, 2007

ERICA CRAIG
CONSTRUCTION MANAGEMENT
DR. RILEY

Erica L. Craig
Construction Management
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Dr. Riley

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EXECUTIVE SUMMARY

SECTION I

This report is intended to provide information on areas of the project that are good candidates for research, alternative methods, value engineering, and schedule compression. Included is a detailed review of each session of this year's PACE roundtable and a critical industry issue I wish to pursue through further research. Also included are problematic features of Geisinger Gray's Woods Ambulatory Care Campus, analysis activities with research methods, and a detailed weight matrix for all proposed analyses.

PACE roundtable sessions included discussions on prefabrication, BIM, and workforce development. Industry members are eager to collaborate to solve these issues as well as to share their advice and experience on prefabrication, BIM, and workforce development. For Gray's Woods, approvals and permitting caused substantial schedule delays for the project. Another current industry issue is the time and costs associated with the approval and permitting processes.

There are several areas of improvement for Gray's Woods that involve the concrete floor system, curtainwall system, HVAC system, and the brick masonry facade. Core areas of analysis include value engineering, constructability reviews, and schedule reduction or acceleration. Proposed research analysis will occur for the concrete floor system and HVAC system as well as the industry research on approvals and permitting.

CRITICAL INDUSTRY ISSUES

SECTION II

The 16th Annual PACE Roundtable
October 23-24, 2007
Building Collaboration

Session 1: Prefabrication

The main purpose of this topic was to discuss the idea of the US adopting successful prefabrication practices as used throughout the rest of the world. Dr. Michael Horman started the session by introducing the idea of using prefabrication for LEED certified buildings. His focus was on the mechanical and piping systems of these buildings. Stan Carlat of Hensel Phelps, James Haller of Southland Industries, and Charles Yetter of Tishman Speyer each discussed their ideas. In my opinion, the four main concepts discussed at this session regarding prefabrication are:

1. Prefabrication for LEED buildings
2. Traditional vs. Design-Build involvement with prefabrication
3. Single vs. Multiple trade coordination for prefabrication
4. Code and liability issues of prefabrication

Using prefabricated building components for LEED certified buildings has many benefits. For the most part, utilizing prefabrication for the mechanical and piping systems was discussed at the roundtable. First, the efficiency of the systems is greatly increased which lowers the buildings mechanical and piping operating costs. Secondly, prefabrication will minimize the amount of waste produced. Considering that prefabrication can occur in a controlled environment, another benefit is that the products and systems installed will be much cleaner and will have better quality so to work the way it was designed.

Taking into account that my thesis building, Geisinger Gray's Woods Ambulatory Care Campus, is designed to be LEED certified, I feel as though this issue could be researched to evaluate the effect it may have on th schedule as well as value engineering. I hope to study prefabrication not only for the mechanical system, but also the building façade which is comprised of a large curtain wall system, EIFS, and brick masonry. From the PACE roundtable, I feel as though my two main contacts regarding prefabrication for mechanical systems will be Dr. Horman and James Haller of Southland

Industries. In addition, I would like to keep in touch with Stan Carlat to discuss the possibility of prefabrication for the building façade.

After hearing both students and industry members express their concerns and knowledge of prefabrication, I was intrigued to find out that the US is far behind other countries standards when it comes to prefabrication. Not being very familiar with foreign construction methods, I had no idea there was such a vast difference here in the US.

Session 2: Building Information Modeling – BIM

This second session was set forth to focus on the motivators and pioneers of BIM and how they are helping the continued development and usage of BIM throughout the industry. With a panel of Dr. John Messner and three industry members – Kurt Maldovan of Jacobs Engineering, Todd Vochinsky of Barton Malow Company, and Alber Zulps of Skanska – the discussion in my opinion broke down into both the benefits and issues of BIM implementation. The majority of the session was geared to BIM for Mechanical, Electrical and Structural trades.

Personally, I feel as though at this stage of development, BIM has far more issues and concerns than benefits. For those currently using BIM or considering the implementation of the BIM computer operating systems, it seems challenging to have a standard to which all of industry can build upon. Along those same lines, the training and re-training necessary to operate the computer systems requires additional time and money for all parties involved. Coordination on a computer program may seem logical, but the actual constructability of the building components in the field may not be considered until it is too late. Currently, subcontractors are the primary user of BIM but the need for design professional's involvement early in the project seems evident. For this, however, design liability for both the design professional and subcontractor would be present. Lastly, if BIM is to be used on a project, this decision would need to happen in the beginning stages by the owner. The problem arises in the need to educate owners and clientele of the benefits of BIM.

On the other hand, numerous benefits of BIM were also discussed at this session. With the concept of interoperability and that access to information is power, BIM can aid in construction applications such as estimating, scheduling and design coordination. Efficiency of systems and construction practices are also increased with the use of BIM. Some industry members also feel that BIM can assist with digital fabrication and help the processes for prefabrication of systems to further design coordination. BIM consulting groups are available to provide support and services to facility

management, building design, and construction professionals. With BIM classes offered to current college graduates, the resources and knowledge are readily available to those who are interested in the BIM concepts. Lastly, with fewer in-field conflicts, time spent for RFI's and design errors are greatly reduced.

Several concerns arose in my mind during the discussion. First, do other AE options get opportunities with BIM? With ideas of design professionals using BIM, I feel as though education now would lead to more success in the future. Secondly, with the push for more training and another system for construction members to use, does this add more stress and cause burnout? Perhaps it is almost necessary to have a separate team member for subcontractors and construction managers to manage BIM processes on the project.

At Gray's Woods Ambulatory Care Campus, utilizing BIM would be a challenge. My concerns lie in the fact that construction trades and the owner involved do not have a deep understanding of the BIM processes which would correlate to more time and money necessary for this project. If further research could be done, I feel as though Jeff Smith of Alexander Building Construction would be the best contact for the Central PA area and liaison for Geisinger Health Care. Research of other projects in the State College area and contacting the construction trades on the project would help be understand how BIM is being used in this area.

Session 3: Labor & Management Shortages – Workforce Development

As the last topic of this years PACE roundtable, industry members and students were discussing creative techniques that could be used to combat labor and management challenges. From apprentice programs to adjusting to technology, Dr. David Riley along with Michael Miller of Southland Industries, Steven Smithgall of Balfour Beatty Construction and Ray Sowers of ONCORE Construction lead the session.

Below is a list of techniques discussed during the session that could help recruiting and retaining laborers:

- Stress the benefits that are provided such as health and retirements plans to push laborers to make this a career, not just a job.
- Keep/add apprentice programs to open pathways to higher positions.
- Consider high schools, technical schools and junior colleges when looking for possible employees.

- To keep up with the workload, look for other opportunities such as prefabrication instead of recruiting/retaining employee's enforcement.

The biggest step we could take at the moment is to try and improve the image of construction workers. First, pay is good with some (crane operators) making nearly six figures a year. As other industry wages increase however, we need to adjust labor wage rates as well. With working in unfavorable environmental conditions, education on prefabrication will allow for work in clean, safer areas.

Another concept to stress is that employee growth and advancement is encouraged. The owner is under the mindset to give more opportunities to employees from within. Many laborers with drive and determination have progressed from in-field positions to managerial positions.

After speaking with Raissa Wetcher of Forrester Construction Company during PACE and hearing John Tarpey of Balfour Beatty Construction in our construction management class, both stressed that finding your passion within the construction industry can be difficult. As with any job or career, employees only stay with the company if they are happy and content. When choosing a company to work for, in my opinion, it is still not clear which makes which the best option. The technique discussed during the session that stood out in my mind was entering high schools, technical schools to encourage students to enter into the construction field. Education is minimal regarding careers in the construction industry during these vital years.

CRITICAL ISSUES RESEARCH METHOD

SECTION III

Problem

With scheduling continually being an issue for new construction projects, it is important for industry members to evaluate where time and money are being wasted. For Geisinger Gray's Woods Ambulatory Care Campus, numerous approvals and permits delayed the project three months. Specifically, the DEP Act 537 permit was submitted for approval on September 14th, 2006 with approval scheduled for December but was not actually issued until March 1st, 2007. I have found that many other projects throughout the US have experienced this same problem, and at times, encounter an even larger delay from approvals and permits.

Solution

The solution to this problem involves:

- standardizing permit processes within each state,
- enforcing open lines of communications from owners, contractors and design professionals to permit agency members, and
- authorizing a time constraint for various approval periods.

I plan to contact owners, contractors, design professionals, municipalities, region officials, and various government agencies regarding possible solutions to this problem. Also, I would like to speak with attorneys who have dealt with difficult legal construction cases relating directly to delays due to permitting. It will be necessary to research various project types and various state governments. Some focus, however, will cover health facilities in the PA area.

The following are a few questions that would be beneficial to finding a solution:

- Are you responsible for applying for any or all building permits for commercial construction projects?
- If so, what is the most time and money consuming component of the process?
- Are there some permits that are easier to obtain than others?
- What, do you feel, is the best way to deal with permitting to not delay projects?
- If changes where made to the process, do you feel the construction industry would be supportive of the revisions?

PROBLEM IDENTIFICAITON

SECTION IV

There are several different features of the Geisinger Gray's Woods Ambulatory Care Campus building that could be redesigned or altered to reduce the construction schedule, create value for the project, or simply make it easier to construct. Some of these issues will be discussed in future proposals after more research and development have occurred.

Structural Concrete Slabs

At Gray's Woods, the second floor and roof concrete slabs are design with lightweight concrete on metal decking. Although construction methods are similar for both, lightweight concrete costs far more than normal weight concrete. As a value engineering technique, project costs could be substantially lowered. With normal weight concrete, structural steel columns, beams, and decking would need to be redesigned to accommodate for the increased dead loads. If steel member size increases, constructability would be evaluated to ensure the correct crane size.

Curtain Wall System

As designed, the entire front façade and several other areas consist of a curtain wall system. For LEED accreditation, it is important to incorporate natural day lighting. However, some issues have occurred regarding the constructability of the system. Curtain wall construction requires numerous lifts, heavy manpower and detailed connections. Prefabricated unitized curtain wall panels could reduce the number of lifts required, reduce manpower needed on site, and make fewer field connections. Additionally, unitized panels would ensure quality connections to reduce air leaks, and could reduce the construction schedule in the field. If there is repetition of panel design, unitized panels can also be cost effective. Nevertheless, the implementation could change the architectural façade of the building and interior structural system.

HVAC System

To accommodate the large boilers and chillers, an additional building was required to house these units. Being separated from the main medical office building, additional costs and time was spent on the chiller/boiler room. Compared to the typical rooftop commercial HVAC system, a chiller and boiler were chosen to gain energy efficiency points for LEED certification. With large

costs implications of chillers and boilers, value engineering of a different system should be done while keeping LEED credits in mind. Furthermore, a schedule and constructability analysis possibly will be done on redesigning a separate building for the HVAC equipment to an interior or attached room to the building.

Brick Masonry

At Gray's Woods, the entire north facade as well as portions of the West and East facades is brick masonry. In addition, the exposed walls of the boiler/chiller building are brick masonry. The use of brick masonry requires a large amount of scaffolding and personnel for installation. With this, congestion on the site occurs as well as a lengthy schedule for masonry brick construction. Precast masonry brick panels allow for less scaffolding, less personnel on site during installation, better quality construction and a reduced schedule time. Detailed connects and heavy lifts need to be taken into consideration when using precast masonry brick panels on top of longer lead times from offsite facilities.

TECHNICAL ANAYLSIS METHODS

SECTION V

From the previous section, Problem Identification Section IV, the following areas of study have been chosen for further research and analysis. Each analysis will include a problem statement, proposed solution is applicable, and methods and steps needed for research. Within each analysis, core areas of examination include value engineering, constructability reviews, and schedule reduction/acceleration.

Normal Weight Concrete Slabs

Problem Statement: Although both lightweight and normal-weight concrete can fulfill the same structural function, there is a significant cost premium for lightweight concrete. With the comparison of the concrete slabs, the structural steel design will need to be re-evaluated for the normal weight concrete and well as an additional cost comparison.

Proposed Solution: Provide information comparing the benefits and drawbacks of the two slab systems.

Research Needed:

- Redesign of structural system
- Value engineering analysis of normal weight concrete slab
- Constructability review of each slab system
- Cost analysis of new structural steel system
- Evaluate any schedule effects of both slab systems
- Fire-proofing effects of new system
- Consult the Structural Engineer as well as concrete contractors

HVAC System Analysis

Problem Statement: In comparison to typical commercial HVAC systems, using a separate boiler/chiller building requires additional costs and time. Moreover, the large boilers and chillers required for the building have even more cost implications for the project.

Proposed Solution: Provide information on benefits and drawbacks of both a redesign of the boiler/chiller building and the comparison of possible HVAC systems.

Research Needed:

- Value engineering of typical commercial HVAC system
- LEED evaluation of other possible HVAC systems
- Value engineering of other LEED HVAC systems and life-time cycle costs
- Constructability review of redesign of boiler/chiller room
- Value engineering of redesign of boiler/chiller room
- Redesign of HVAC system based on possible solutions
- Evaluate any schedule effects of different solutions
- Analyze maintenance effects
- Consult HVAC Engineers, Construction Managers, and HVAC contractors

WEIGHT MATRIX

SECTION VI

The following weight matrix demonstrates the areas of studies and the distribution of effort for the technical analysis mentioned in the previous section.

Description	Research	Value Engineering	Constructability Review	Schedule Reduction	Total
Analysis 1 **Normal Weight Concrete Slabs**	-	15%	10%	10%	35%
Analysis 2 **HVAC System Analysis**	-	10%	10%	15%	35%
Analysis 3 **Approvals & Permits**	30%	-	-	-	30%
Total	30%	25%	20%	25%	100%